# PATENT SPECIFICATION

Convention Date (Germany): May 2, 1936

473,471

Application Date (In United Kingdom): April 7, 1937. No. 9882/37.

Complete Specification Accepted: Oct. 13, 1937.

COMPLETE SPECIFICATION

## Improvements in Atomisers for Drying Purposes

I, EMIL KIRSCHBAUM, a German Citizen, of Eisenlohrstrasse 6, Karlsruhe i.B., Germany, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

Liquids containing dissolved or suspended substances are atomised for the purpose of drying the substances, the object being the production of a large surface for contact with the drying gases. Stationary atomising nozzles exist in which the liquid before it issues from the nozzle is given a circular movement. These devices, however, are not useful for viscous liquids and even in the case of liquids which are not viscous the nozzles are very easily choked owing to the necessarily small dimensions of the nozzle opening. In rotary atomisers there is set up by the rotation a relative movement between the air and the stream of liquid issuing from the nozzle. The liquid particles are first given a high speed and then torn asunder by their movement through the air which is at rest or in slow current. Rotary atomisers are costly to instal, as not only is a large drying tower necessary but also a separate motor for rotating the plate carrying the nozzles. Moreover, many substances cannot be dried by use of these nozzles owing to the limited path afforded the liquid droplets. The invention relates to a device which avoids or minimises the above disadvantages.

The invention is based on the idea that the relative speed necessary for disrupting the liquid should be produced by imparting the high speed not to the liquid but to the drying gas and by bringing this very rapidly streaming gas into contact with the liquid practically at rest or moving very slowly. The gas can very simply be brought to high speed by letting it stream under excess pressure through a stationary nozzle. Immediately in front of the exit from the nozzle the liquid to be atomised is introduced into the stream of gas substantially at right angles to the direction of the stream of gas. A very extensive investigation was necessary in order to find the several dimensions and the arrangement of this nozzle as well as the proportions of gas and liquid to be used in order to attain an advantageous result.

The accompanying drawing illustrates the invention.

Fig. 1 illustrates the principle. It represents a two-sided liquid nozzle. On both sides of the air nozzle 1 there is a liquid channel 2 and 3. As compared with the arrangement of only one liquid channel placed on one side the arrangement illustrated has the great advantage that with a given weight of gas twice the weight of liquid can be atomised. Thus air compression can be economised. The proportion of the air (primary air) necessary for the atomisation to the total mass of air necessary for the drying is diminished. It has been found that this proportion may be only about 8 per cent. This small quantity of air need have only a small excess of pressure, generally amounting to about 10 cm. mercury column before it enters the nozzle.

The dimension $a$ (Fig. 1) must be so selected that on the one hand the atomisation is good while on the other hand blocking of the channel for the liquid is impossible. From the latter point of view the dimension $a$ must not be too small. The investigation has shown that the most favourable output is attained when both the requirements are satisfied by the selection of a certain width of the channel, namely if the dimension $a$ is smaller than 1 mm. then the atomisation is poor and there is danger that the channel may become choked. The best atomisation is produced by a width of channel of between 1 and 5 mm. In these circumstances choking also becomes impossible.

For good atomisation it is further necessary that the edges $K_1$ and $K_2$ of the channel which lie opposite the cross-section of the air outlet should be sharp. The edges $K_1$ and $K_2$ must lie close to the lines $g_1$ and $g_2$ parallel to the axis of the air nozzle. If they are nearer to the said axis or further from it the atomisation is not so good, even though in the latter case the air current acts to soak the

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liquid.

The incline of the sharp edges S (Fig. 1) is of great importance. If it lies on the inner side of the channel 2, 3 the atomisation is better. Then the larger quantity of liquid calculated on the unit length of the nozzle can be carried forward and the formation of drops on the outside of the channel wall is avoided with greater certainty than is the case when the inclines in question are on the outer surfaces of the wall of the channel and therefore turned towards the direction of the outflow of the liquid.

The angle $\alpha$ (Fig. 1) at which the channel for the liquid on the one hand and the channel for the air on the other hand meet each other was varied in the investigation. The best effect was attained when $\alpha$ was between 80 and 90°, that is to say when the two channels were approximately at right angles to each other.

The nozzle represented in cross-section in Fig. 1 may be constructed in plan as a rectangle so that the nozzle openings are rectangular; if the length of the rectangle is 1 cm. about 5 litres of liquid can be atomised per hour, provided the physical properties of the liquid are similar to those of water. In order that there may be no formation of drops of liquid at the ends of the channel it is necessary that the slot for the issue of air should be at least 2mm. longer than the opening for liquid so that the outlet for air projects on both sides somewhat beyond the slot for the liquid.

A modification of the invention is the atomising nozzle illustrated in Fig. 2. It is intended for large outlets. The atomising air is supplied through the annular channel 1. The liquid flows on the one hand through an annular channel 2 in radial direction from the outside inwards and on the other hand through channel 3 in radial direction from the centre outwards. The secondary air, that is to say the air which is not used for atomising, must in this case be supplied to the drying tower at a separate place close to the nozzle. If the nozzle is arranged at the upper end of a vertical cylindrical tower it is possible by varying the height of the tower to increase as may be desired the drying path in which the goods to be dried and the gas move in the same direction so that even substances which can be dried only with difficulty may be freed from their moisture.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. An atomiser for the purpose of drying wherein a nozzle fed with a stream of gas at high speed is mounted between two oppositely placed channels for liquid to be atomised arranged substantially at right angles to the gas stream, the said channels at their exit end being provided with sharp edges the inclination of which is preferably on the inside face of the edge, these edges being symmetrical about the axis of the nozzle and the distance between them being equal to the breadth of the opening for the issue of air while the length of the latter projects on each side by at least 1 mm. beyond the channel for the liquid.

2. An atomiser for the purpose of drying wherein the nozzle for the atomising air is of annular form and at the whole periphery of the annular opening for the issue of air the liquid to be atomised flows from both sides as well from outside inwards and from inside outwards in channels which are provided at their exit ends with sharp edges the inclination of which is preferably on the inside face of the edge, these edges being symmetrical about the annular edges of the nozzle and the distance between them being equal to the breadth of the annular opening for the air.

3. An atomiser as claimed in claim 1 or 2 wherein the liquid is supplied to the air stream only from one side.

Dated this 7th day of April, 1937.

ABEL & IMRAY,
Agents for the Applicant.

Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1937.

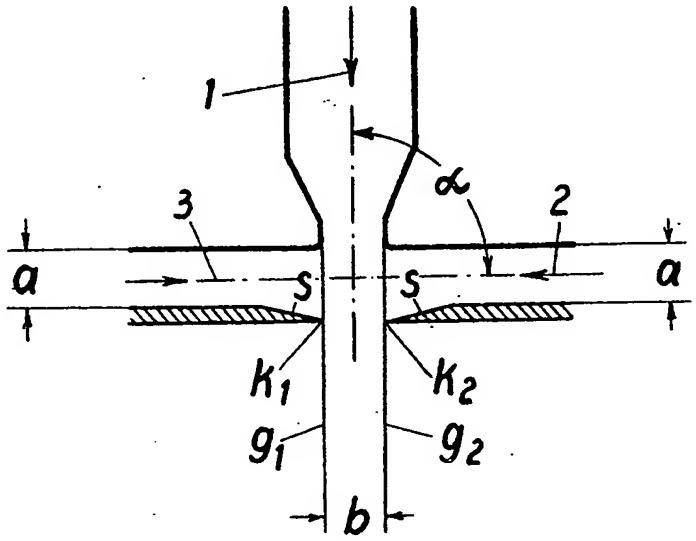


Fig. 1

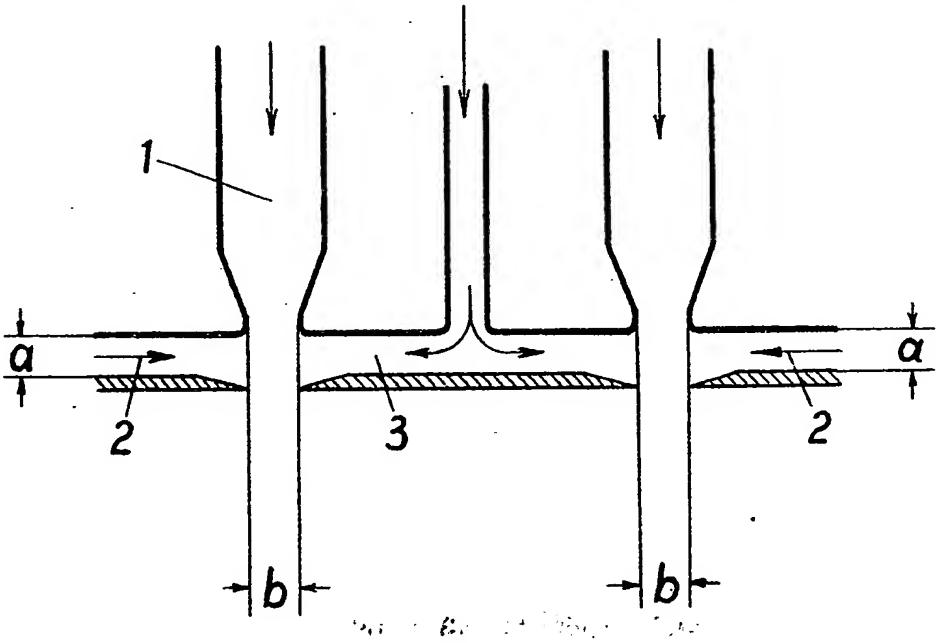


Fig. 2

Malby & Sons, Photo-Lith.